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ABSTRACT

The effects of meaningfulness of the stimulus materials and the presence or absence of contextual cues on problem-solving behavior were investigated. Third-graders (N=80) were randomly assigned to one of four conditions and their performance in a series of discrimination problems was observed. Subjects in Conditions I and II responded to stimuli composed of abstract dimensions such as letter, color, size, and line position. Subjects in Conditions III and IV responded to more concrete (meaningful) dimensions such as cheese, carrot, camel, and crow. Contextually, Conditions II and IV differed from I and III in that subjects received contextual cues (stories) about the stimuli. In Condition II, the stories conveyed information about the dimensional properties of the stimuli (i.e., letter, size, color, line position), while in Condition IV the stories related to the objects in the pictures. In general, results indicated that the best performance on several dependent measures was obtained when children were presented meaningful stimuli and received a story (contextual cue) about the stimuli (Condition IV). These children solved more problems, manifested more consistent hypotheses during probes, were more likely to retain a hypothesis following positive feedback, and were more likely to abandon a hypothesis following a negative feedback than were subjects in any other condition. (Author)

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Effects of Meaningfulness and Context on Information Processing in Third-Graders

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Effects of Meaningfulness and Context on Information Processing in Third-Graders

Conceptual development and problem solving behavior in humans has been studied in the context of Levine's (1966, 1969, 1975) version of hypothesis theory. According to this theory, at the outset of a discrimination problem the individual selects an hypothesis from some set of hypotheses and responds on the basis of the one selected. It is assumed that subjects make choice responses in such a way that if their hypothesis is indeed correct they will choose correctly. Research has demonstrated that subjects' hypotheses can be reliably determined using a blank-trial probe technique. Employing this technique, a series of no feedback trials (blank-trial probes) are inserted between feedback trials of a problem such that the pattern of responses within a set of no feedback trials will specify the hypothesis which determined the subject's choice response. In a problem with bi-valued four dimensional stimuli, for example (Figure 1), a subject's hypothesis might be that "large" is correct, regardless of color, form, or line position. The side containing the large stimulus would then be chosen on successive trials. When feedback is delivered, subjects behave in accordance with its value. That is, confirmed hypotheses are usually maintained and disconfirmed hypotheses are rejected. Subjects test and abandon hypotheses until one is selected that results in correct responses on a criterion series of trials.

The application of Levine's techniques to children has revealed that children's behavior is highly systematic in a problem solving situation; that is, they do not respond randomly but manifest sequences of responses that correspond to simple hypotheses most of the time. In addition, they manifest hypotheses in systematic sequences that seem to be dicatated by plans. These plans, which are inferred from the pattern of hypotheses shown across a series of probes and feedback trials, can be described in terms of relative efficiency of information processing each implies. A developmental continuum of sophistication in the different plans, or hypothesis-sampling systems, exhibited by children of various ages has been reliably observed. Thus, hypothesis-theory provides a conceptual framework within which it is possible to describe the development of human conceptual behavior in problem solving situations.

While numerous task and subject variables have investigated using Levine's technique, the effects of meaningfulness of stimuli and contextual cues have not been evaluated. Bartlett 1932, Bransford and Johnson 1972, Jenkins 1972 and a host of other researchers have elaborated the importance of meaningfulness and context in information processing. A 2 x 2 factorial design was used in the present study to investigate the effects of meaningfulness of the stimulus materials (in the form of concrete versus abstract objects) and the presence or absence of contextual cues (in the form of stories) on problem solving behavior.

The subjects were 80 third-graders from an elementary school in Commerce, Georgia. Twenty children were assigned to each of four groups. Stimulus sequences in each problem were arranged to meet Levine's (1966)

orthogonality criterion and they contained blank-trial probes of the type illustrated in Figure 1. Details of this type of problem construction have been published in numerous places, so only two implications will be considered here. Consecutive blank-trial probes were constructed so that each of the eight hypotheses yielded a pattern of three responses to one side and one response to the other. In addition, any three consecutive feedback trials logically defined the solution.

Subjects in Conditions I and II were presented with stimulus objects composed of dimensions that were relatively abstract: letter, color, size, and line position. Subjects in Conditions III and IV were presented more concrete (meaningful) dimensions: animals, people, clothing, and food. Conditions II and IV differed from I and III in that subjects received contextual cues (stories) about the stimuli. In Condition II these stories conveyed information about the letter, size, color and line position dimensions. In Condition IV the stories related to the concrete objects in the pictures.

It was hypothesized that children who were presented meaningful stimuli would show better performances on the various dependent measures than would children presented the more abstract stimuli. On most dependent measures this hypothesis was confirmed. These children manifested more hypotheses, solved more problems, and were more locally consistent following negative feedback. Table 1 presents this data. In addition (see Figure 2), on problems categorizable into one of the hypothesis-sampling systmes, these children's hypotheses seemed to be dictated by more sophisticated plans than children in other groups. The best performances, however, were obtained when children saw meaningful

stimuli and received contextual cues (stories). In addition to the best performances on the above measures, these children were more likely to abandon hypotheses following negative feedback.

Thus, the results of the present study provide support for the view that meaningful stimuli are important in information processing. Children presented meaningful stimuli showed better performance on most dependent measures than children presented more abstract stimuli.

It is suggested that the presentation of meaningful stimuli enhanced performance by facilitating recall of the dimensions in each problem. Each time children saw a new stimulus complex with objects often encountered in their daily interactions, it was easier for them to recall the stimuli. The additional contextual cues (stories) enhanced performance even more in Condition IV, by providing an "immediate" context within which the particular cues involved could be structured for remembering. This structuring of cues for remembering did not always, however, enhance performance for subjects who obtained contextual cues (stories) about the more abstract stimuli. Rather, on some occasions these children were able to use the contextual information but on others they could not. Children's failure to use the contextual information successfully to process information is evidenced in the hypothesis-sampling systems data presented in Table 2. A decrease in the dimension-checking and hypothesis-testing strategies, typically manifested among children in this age group, can be seen in Figure 2. There is also an increase in the manifestation of less efficient problem solving behaviors such as stereotypic and unsystematic sampling. These patterns are typically observed among younger children.

Figure I A stimulus sequence which permits inference of each of eight simple hypotheses. Each card contains two stimulus arrays, each containing one of the two values of the four dimensions. The entire set of four cards constitutes a blank-trial (no feedback) probe. Each hypotheses pattern involves the three responses to one side and one to the other.

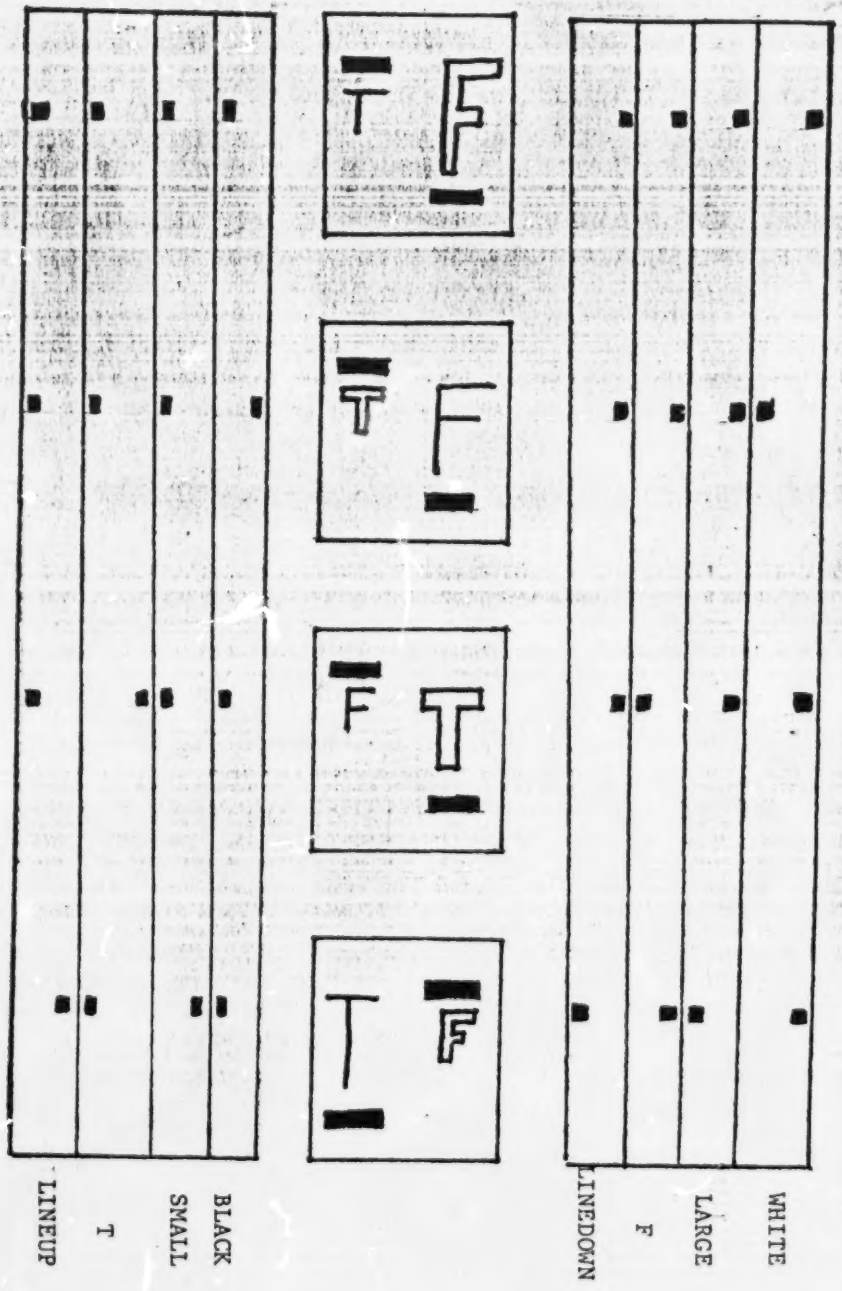


Table 1 Mean percentages of hypotheses manifested, problem solved, locally consistent sampling, and disconfirmed hypotheses maintained

Dependent Measures	Conditions*			
	I	II	III	IV
Hypotheses Manifested	60.96	58.30	63.76	71.47
Problems Solved	16.83	24.78	33.52	35.65
Disconfirmed Hypotheses Maintained	11.67	17.40	14.25	3.59
Locally Consistent Sampling	60.80	55.63	63.10	68.73

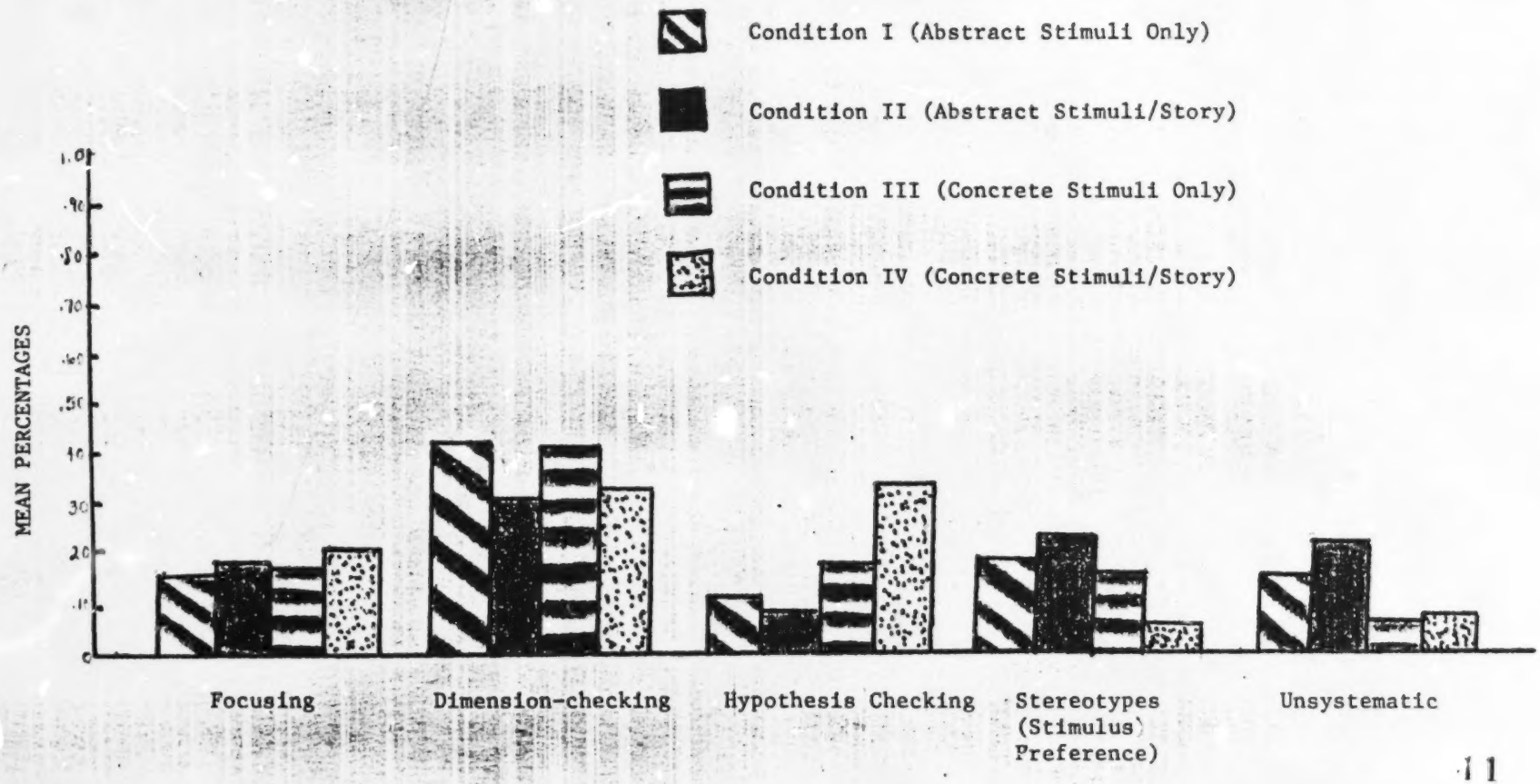
*Condition I (Abstract Stimuli Only)
Condition II (Abstract Stimuli/Story)
Condition III (Concrete Stimuli Only)
Condition IV (Concrete Stimuli/Story)

Table 2 Percent Hypothesis-Sampling Systems among third-graders under four experimental conditions.

Hypothesis-Sampling System	Condition*			
	I	II	III	IV
Focusing	15	17	16	21
Dimension-Checking	43	31	42	32
Hypothesis-Checking	10	8	21	33
Stimulus-Preference	17	23	15	5
Unsystematic	15	21	5	9

* Condition I (Abstract Stimuli Only)
Condition II (Abstract Stimuli/Story)
Condition III (Concrete Stimuli Only)
Condition IV (Concrete Stimuli/Story)

Figure 2 Percent hypothesis sampling systems among third-graders under four experimented conditions



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